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DIVISION 16 - ELECTRICAL

SECTION 16276J

PAD MOUNTED TRANSFORMERS

02/05

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PAD MOUNTED TRANSFORMERS  
02/05

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NOTE:  
This section covers single- and three-phase pad  
mounted dry-type and oil-insulated transformers.  
Drawings should indicate size, type, and  
installation details.  
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PART 1 GENERAL

The two padmounted 500 kVA transformers shown on the project drawings shall be provided to the Subcontractor as government furnished equipment for installation by the Subcontractor. The equipment specifications in this section are for information. Subcontractor shall follow all installation practices described in this section with specific reference to the applicable sections of UL 506.

1.1 REFERENCES

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NOTE: The following references should not be  
manually edited except to add new references.  
References not used in the text will automatically  
be deleted from this section of the project  
specification.  
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The publications listed below form a part of this section to the extent referenced:

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C37.47	(2000) For High Voltage Current-Limiting Type Distribution Class Fuses and Fuse Disconnecting Switches
ANSI C57.12.26	(1993) Pad-Mounted Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers for Use with Separable Insulated High-Voltage Connectors, High-Voltage, 34 500 Grd Y/19 920 Volts and Below; 2500 kVA and Smaller
ANSI C57.12.28	(1999) Pad-Mounted Equipment - Enclosure Integrity
ANSI C57.12.29	(1991) Pad-Mounted Equipment - Enclosure Integrity for Coastal Environments
ANSI C62.11	(1999) Standard for Metal-Oxide Surge

Arresters for Alternating Current Power  
Circuits

ASTM INTERNATIONAL (ASTM)

ASTM D 877 (2000) Standard Test Method for Dielectric  
Breakdown Voltage of Insulating Liquids  
Using Disk Electrodes

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 386 (1995;R 2001) Standard for Separable  
Insulated Connector Systems for Power  
Distribution Systems Above 600V

IEEE C57.12.00 (2000) Standard General Requirements for  
Liquid-Immersed Distribution, Power, and  
Regulating Transformers (ANSI/IEEE)

IEEE C57.12.26 (1992) Transformers - Pad-Mounted  
Compartmental-Type, Self-Cooled,  
Three-Phase Distribution Transformers for  
Use with Separable Insulated High-Voltage  
Connectors, High Voltage, (34,500 Grd  
Y/19, 920 and Below; 2500 kVA and Smaller)

IEEE C57.12.80 (2002) Standard Terminology for Power and  
Distribution Transformers

IEEE C57.12.90 (1999) Standard Test Code for  
Liquid-Immersed Distribution, Power, and  
Regulating Transformers (ANSI/IEEE)

IEEE Std 62 (1995) Guide for Diagnostic Field Testing  
of Electric Power Apparatus--Part 1: Oil  
Filled Power Transformers, Regulators and  
Reactors

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ST 1 (1988) Specialty Transformers (Except  
General Purpose Type)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FED-STD 595 (Rev B) Colors Used in Government  
Procurement

UNDERWRITERS LABORATORIES (UL)

UL 506 (2002) Specialty Transformers

1.2 GENERAL REQUIREMENTS

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NOTE: If Section 16003, "General Electrical Provisions," is not included in the project specification, applicable requirements therefrom should be inserted and the following paragraph deleted.

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NASA Section 16003, "General Electrical Provisions," applies to work specified in this section.

Certification of previous tests on similar units under actual conditions may be submitted for impulse tests, temperature rise tests, sound tests, power-factor tests, bushing tests, and short-circuit tests in lieu of factory tests on actual units furnished.

Equipment and performance data shall be submitted for distribution transformers including resistance measurements, impedance, and voltage and load losses at rated currents and comply with the applicable provisions of NEMA ST 1, and IEEE C57.12.26.

Equipment foundation data for distribution transformers shall include plan dimensions of foundations and relative elevations, equipment weight and operating loads, horizontal and vertical loads, horizontal and vertical clearances for installation, and size and location of anchor bolts.

### 1.3 SUBMITTALS

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NOTE: Review submittal description (SD) definitions in Section 01330, "Submittals," and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control. Include a columnar list of appropriate products and tests beneath each submittal description.

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The following shall be submitted in accordance with Section 01330, "Submittals," in sufficient detail to show full compliance with the specification:

#### SD-02 Shop Drawings

The following shall be submitted for distribution transformers:

Connection Diagrams  
Fabrication Drawings  
Installation Drawings

### 1.4 FACTORY TESTING

Tests on transformers shall comprise the manufacturer's standard tests including resistance measurements of all windings; ratio tests; polarity and phase-relation tests; no-load loss at rated voltage; impedance; voltage and load loss at rated current; insulation power factor (Doble) tests, insulation oil tests, and dielectric tests. For oil-filled units manufacturer shall certify that the oil contains no PCB's and shall affix a label to that effect on the transformer tank and on each oil drum

containing the insulating oil.

## 1.5 DRAWINGS

Connection diagrams shall be submitted for distribution transformers indicating the relations and connections of devices and apparatus by showing the general physical layout of all controls, the interconnection of one system or portion of system with another, and internal tubing, wiring, and other devices.

Fabrication drawings shall be submitted for distribution transformers consisting of fabrication and assembly details to be performed in the factory.

Installation drawings shall be submitted for distribution transformers in accordance with the paragraph entitled, "Installation," of this section.

## PART 2 PRODUCTS

### 2.1 EQUIPMENT STANDARDS

#### 2.1.1 Pad-Mounted Liquid-Filled Dead Front, Loop Feed Distribution Transformers

Pad-mounted liquid-filled distribution transformers with primary connections to underground high-voltage lines and secondary connections to underground low-voltage distribution feeder circuits shall be two-winding, three-phase, voltage and kVA as indicated, 60-hertz, oil-immersed, 65-degree C rise, self-cooled, Class KNAN, outdoor type, conforming to ANSI C57.12.26, IEEE C57.12.00, IEEE C57.12.80, and IEEE C57.12.90. Three-phase pad-mounted transformers shall be delta/bye connected. Winding shall be copper. Comply with the applicable provisions of NFPA 70.

#### 2.1.2 High Voltage

High-voltage compartment shall contain the incoming line, three insulated high-voltage load-break connectors with bushing well inserts, six high-voltage bushing wells, three surge arresters, access to oil-immersed bayonet fuses, tap changer handle, connector parking stands with insulated standoff bushings, protective caps, and ground bus. Comply with the applicable provisions of NFPA 70.

- a. Insulated high-voltage load-break connectors: IEEE 386, rated 15kV, 95 kV BIL. Connector shall be equipped with grounding tab, test point, and pulling eye.
- b. The transformer primary shall include a loadbreak bayonet fuse assembly with a flapper valve to minimize oil spillage. Overcurrent protection shall be provided by a bayonet expulsion fuse mounted in series with a partial range under-oil ELSP current-limiting fuse with an interrupting rating of 50,000 A. Bayonet fuse shall sense both overcurrent and high oil temperature in order to provide thermal protection to the transformer. Oil-immersed current-limiting fuses: ANSI C37.47; 150kV BIL; 50,000 amperes symmetrical interrupting rating.

The transformer shall be provided with six (6) high voltage bushings rated for full three-phase duty for loop feed configurations in a radial feed application.

- c. Surge arresters: Primary overvoltage protection shall be provided by externally mounted, heavy-duty distribution class M.O.V.E. deadfront elbow arresters conforming to ANSI C62.11, rated 10kV, fully shielded, dead-front, metal-oxide-varister, elbow type with resistance-graded gap, suitable for plugging into bushing well inserts. Provide three arresters for radial feed application.

#### 2.1.3 Low Voltage

Low-voltage compartment shall contain low-voltage bushings with copper spade terminals for service lugs, accessories, stainless steel diagrammatic transformer nameplate, and ground bus.

- a. Accessories shall include drain valve with sampler device, fill plug, pressure relief device, liquid level gage, pressure-vacuum gage, and dial type thermometer with maximum temperature indicator.
- b. The low-voltage bushings shall be molded epoxy, and provided with 8-hole blade-type space terminals with ANSI standard hole spacing arranged for vertical take-off. The low voltage neutral shall be an insulated X0 bushing, grounded to the tank by a removable ground strap. Comply with the applicable provisions of NFPA 70.

#### 2.1.4 Transformer

- a. Oil-insulated, two winding, 60 hertz, self-cooled type. The average winding temperature rise above ambient temperature, when tested at the transformer rating, shall not exceed 65 degree C.
- b. Transformer shall be rated 500 kVA, 95 kV BIL.
- c. Transformer voltage ratings:
 

Primary	13.2 kV
Secondary	208Y/120V
- d. Entire transformer (tank, base sill and cabinet) shall be stainless steel. All tank fittings and hardware shall be stainless steel. The top cover shall be welded. Fastenings shall be tamper proof. The pad-mounted equipment shall meet the requirements for tamper resistance set forth in ANSI C57.12.28, including but not limited to the pry test, pull test and wire probe test. Lifting lugs and jacking pads will be provided. Transformer shall conform to ANSI C57.12.28 and NFPA 70.
- e. Tap changer shall be externally operated, manual type for changing tap setting when the transformer is de-energized. Provide four 2.5 percent full capacity taps, two above and two below rated primary voltage. Tap changers shall clearly indicate which tap setting is in use.
- f. Minimum tested impedance shall not be less than 4.50 percent.
- g. Audible sound levels shall comply with the following:

<u>kVA</u>	<u>DECIBELS (MAX)</u>
75	51
112.5	55

<u>kVA</u>	<u>DECIBELS (MAX)</u>
150	55
225	55
300	55
500	56
750	57
1000	58
1500	60

- h. Transformer shall include lifting lugs and provisions for jacking under base. The transformer base construction shall be of the fabricated type and suitable for using rollers or skidding in any direction. Provide transformer top with an access handhole. Transformer shall have its kVA rating conspicuously displayed on its enclosure.

#### 2.1.5 Insulating Fluid (Non-PCB)

The dielectric coolant shall be listed, Factory Mutual approved (Approval Standard 3990) and UL Classified "Less-Flammable" per NEC Article 450.

#### 2.1.6 EQUIPMENT FINISH

The transformers shall have the manufacturer's standard finish for highly corrosive areas. The finish shall meet the requirements of ANSI C57.12.29 and shall be No. 7GY3.29/1.5 Munsell Green in accordance with FED-STD 595.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Pad-mounted distribution transformers shall be installed and secured on concrete pads and shall be grounded to a ground grid.

Each pad-mounted distribution shall have its kVA rating conspicuously displayed in 3-inch 75 millimeter high yellow letters on its tank or enclosure in addition to the complete manufacturer's standard identification plate.

#### 3.2 FIELD TESTING

##### 3.2.1 Insulating Liquid Dielectric Test

Transformers shall have the insulating liquid dielectrically tested after installation and before being energized. Insulating liquid shall be tested in accordance with ASTM D 877, IEEE Std 62, and breakdown voltage shall be not less than 25,000 volts.

##### 3.2.2 Insulation Resistance Tests

Transformer windings shall be given an insulation-resistance test using the following test set versus voltage level criteria:

Liquid type 15-to 5-kilovolt transformers - 2,500-volt test set  
(primary)

Tests shall be applied for not less than 5 minutes and until three equal consecutive readings, 1 minute apart, are obtained. Readings shall be

recorded every 30 seconds during the first 2 minutes and every minute thereafter. Minimum acceptable resistance shall be 100 megohms for pad transformers only.

Readings shall be recorded every 15 seconds for the first minute and every minute thereafter for 10 minutes. Resistance between phase conductors and ground shall be no less than the following:

Liquid type 5 to 15 KV

125 megaohms

### 3.2.3 Insulation Power Factor (Doble) Tests

Transformer windings shall be given an insulation power factor test and winding excitation test in accordance with ANSI IEEE C57.12.90. Insulation power factor shall not exceed 0.5 percent for new liquid filled units. New dry type units can have power factors up to 5.0 percent and still be acceptable.

### 3.2.4 Acceptance

Final acceptance shall depend upon the successful performance of the equipment under test. Transformers shall not be energized until recorded test data have been approved by the SGS Subcontract Administrator. Final test reports shall be provided to the SGS Subcontract Administrator

-- End of Section --